

What is claimed is:

1 1. A plasma etching apparatus comprising a chuck for retaining a substrate
2 and hardware that includes oxygen therein such that said oxygen is released when an
3 etching operation is carried out.

1 2. The plasma etching apparatus as in claim 1, wherein said chuck is
2 substantially circular and said hardware comprises a focus ring that peripherally
3 surrounds said chuck.

1 3. The plasma etching apparatus as in claim 1, wherein said chuck is
2 substantially circular and said hardware comprises a focus ring that is annular in shape
3 and at least a portion of said focus ring substantially continuously extends below a
4 peripheral portion of said chuck.

1 4. The plasma etching apparatus as in claim 1, wherein said chuck
2 comprises an electrostatic chuck.

1 5. The plasma etching apparatus as in claim 1, wherein said hardware
2 comprises a focus ring composed primarily of quartz.

1 6. The plasma etching apparatus as in claim 1, wherein said hardware
2 comprises a focus ring formed of a ceramic.

1 7. The plasma etching apparatus as in claim 2, further comprising a further
2 focus ring, said focus ring and said further focus ring forming a focus ring set that
3 peripherally surrounds said chuck.

1 8. A plasma etching apparatus comprising a chuck for retaining a substrate
2 and a focus ring, at least one of said chuck and said focus ring including oxygen therein
3 such that said oxygen is released when an etching operation is carried out.

1 9. A plasma etching apparatus comprising an etch chamber including therein
2 a focus ring and a chuck for retaining a substrate, said focus ring maintainable at a
3 temperature no greater than a temperature of said substrate while an etching operation
4 is carried out upon said substrate.

1 10. The plasma etching apparatus as in claim 9, wherein said chuck
2 comprises an electrostatic chuck and said substrate comprises a semiconductor
3 substrate.

1 11. The plasma etching apparatus as in claim 9, wherein said focus ring
2 maintains contact with said electrostatic chuck and said electrostatic chuck is cooled
3 during said etching operation.

1 12. The plasma etching apparatus as in claim 11, wherein said focus ring is
2 disposed peripherally around said substrate and includes a portion that rests on an
3 annular landing section of electrostatic chuck.

1 13. The plasma etching apparatus as in claim 11, wherein said focus ring
2 includes oxygen therein such that said oxygen is released during an etching process.

1 14. A method for etching a semiconductor device on a substrate, comprising:
2 providing an etching tool including therein a chuck for retaining a substrate and
3 an oxygen-impregnated focus ring; and
4 performing an etch operation such that said oxygen is liberated.

1 15. The method as in claim 14, wherein said providing further includes
2 providing a semiconductor substrate on said chuck and said etching operation includes
3 a gas including $C_x F_y H_z$.

1 16. The method as in claim 14, wherein said providing includes providing a
2 substrate on said chuck and further comprising cooling said substrate with a gas that
3 includes oxygen.

1 17. The method as in claim 16, wherein said gas further include helium and
2 said cooling comprises directing said gas through openings in said chuck.

1 18. A method for etching a substrate comprising:
2 providing an etching apparatus including an etching chamber having therein a
3 chuck for retaining a substrate and a focus ring;
4 etching a film on a substrate disposed on said chuck; and
5 maintaining said focus ring at a temperature no greater than a temperature of
6 said substrate and maintaining at least a portion of said focus ring in contact with said
7 chuck, during said etching.

1 19. The method as in claim 18, wherein said maintaining and said etching
2 occur substantially simultaneously.

1 20. The method as in claim 18, in which said focus ring is formed of quartz
2 and said chuck comprises an electrostatic chuck.

1 21. A method for etching a substrate comprising:
2 providing a substrate on a chuck;
3 etching said substrate ;
4 generating an oxygen plasma and performing a clean operation while said
5 substrate is on said chuck; and
6 further generating a further oxygen plasma and performing a further clean
7 operation while said substrate is positioned above said chuck or a further chuck.

1 22. The method as in claim 21, wherein said providing a substrate comprises
2 providing a semiconductor substrate on a chuck, said semiconductor substrate including

3 a dielectric layer formed thereon, and said etching comprises etching said dielectric
4 layer.

1 23. The method as in claim 21, wherein said generating and said further
2 generating are performed in in-situ.

1 24. The method as in claim 21, wherein said etching includes using $C_xF_yH_z$ as
2 an etching gas.

1 25. The method as in claim 21, wherein said further generating includes said
2 substrate spaced above said chuck by pins that extend above said chuck.

1 26. The method as in claim 22, wherein said dielectric layer includes a
2 dielectric constant less than 3.2 and at least one of said first generating and said further
3 generating includes a pressure less than 100 mT.

1 27. The method as in claim 22, wherein said dielectric layer includes a
2 dielectric constant greater than 3.2 and at least one of said generating and said further
3 generating includes a pressure greater than 50 mT.

1 28. A method for etching a semiconductor substrate comprising:
2 providing an etching tool having an etch chamber including a semiconductor
3 substrate disposed on a chuck and substantially peripherally surrounded by a focus ring
4 that includes oxygen incorporated therein;
5 performing an etching operation such that said oxygen is liberated;
6 during said performing, maintaining said focus ring at a temperature no greater
7 than a temperature of said semiconductor substrate and at least partially in contact with
8 said chuck;
9 after said performing, generating an oxygen plasma and cleaning said
10 semiconductor substrate with said oxygen plasma while said semiconductor substrate
11 is disposed on said chuck;

12 after said performing, generating a further oxygen plasma and further cleaning
13 said semiconductor substrate with said further oxygen plasma while said semiconductor
14 substrate is spaced over said chuck or a further chuck; and

15 cooling by directing a mixture of helium and oxygen through openings formed in
16 said chuck or said further chuck.